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ABSTRACT

In preparing instructional materials, consideration must be given to the students' attention. Carl Hagfors has conducted a number of experiments measuring the electrodermal response simultaneously from a number of subjects viewing the same materials. When most subjects were attentive there was a large discursion of the recorder pen. When some were attentive and others not, the two effects cancel each other out. Such a technique might be easily adapted to aid in the preparation of instructional materials which gain the attention of nearly everyone. Furthermore, the addition of analog computer circuitry would make it possible to monitor the real-time attention of individual students in a class, and allow modification of presentation to recapture the attention of those students who are not being reached. (RH)

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HOW CAN WE SECOND-GUESS ATTENTION IN THE CLASSROOM--A PHYSIOLOGICAL ANSWER

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Among the persistent facts of modern higher education are the ever-growing numbers of students in nearly every undergraduate class.

One response to this student pressure has been the increasing use of mass instructional media. A single lecture when produced as a film, videotape or pamphlet can be shown to many different groups on many different occasions with only minimal additional outlay of resources. In addition, the instructor need not restudy and re-rehearse his material for every presentation of a given body of information, leaving him time to increase his contacts with students.

But the task of preparing instructional material for many groups, separate in both time and space, is formidable, especially as one reviews the extent to which learning has been demonstrated to be subject to audience variables, selective attention, selective perception and selective retention. Since it is attention that represents access to the student's cognitive structure this paper will address the issue of testing mass educational materials to optimize

their appeal to students. It attempts to answer the question, "How can we second-guess selective attention?"

Attention and Its Social Roots

William James conceived of attention this way:

> The immediate effects of attention are to make us:
> (a) perceive
> (b) conceive
> (c) distinguish
> (d) remember
> better than otherwise we could--both more successive things and each thing more clearly. It also:
> (e) shortens 'reaction-time' (James, 1890, 424-425).

Attention from this view involves activation of the sensory apparatus to a stimulus situation. Deutsch and Deutsch (1963) in their model of attention hold that the attentional process must activate the sensory apparatus in general and that it be centered in the mid-brain, possibly the RAS (Reticular Activation System).

At the same time the patterns of stimulation which trigger attention are probably socially derived. A number of investigators in the past forty years have provided proof that the cognitive structure is one of the most important determinants in selection of those stimuli to which humans respond. (See, for example, Bartlett, 1932; Edwards, 1941; Levine and Murphy, 1952; Watson and Hardmann, 1939; or Wallen, 1942)

And From the Orienting Response

The orienting response (OR) is a psychophysiological construct summarizing physiological responses to novel stimuli (Lynn, 1966):

Maltzman and Raskin (1956) connect this OR to attention as it has been described above. Sokolov (1963) hypothesizes a "neuronal model" to explain how the OR operates. In briefest terms, according to the "neuronal model" explanation, each stimulus to which a person has become familiar is represented by a "model" in the cerebral cortex.

When sensory signals arrive at the central nervous system they are compared to the "models" stored in the cortex. If a mismatch occurs, signal is sent to the RAS which in turn activates the sensory apparatus--attention. This results, of course, in greater sensory inputs about the novel or discrepant stimulus. If, on the other hand, incoming sensory data match the "models" in the cerebral cortex, the RAS--and attention--are inhibited.

One of the important implications of the OR and of Sokolov's "neuronal model" explanation is that attention can be indexed by a set of physiological indicators--peripheral vasodilation, the electrodermal response, and pupil dilation. (For a discussion of these variables, see Venables and Martin, 1967). As all of these measures can be recorded continuously and with minimal conscious influence from the subject, it may be possible, using these indices, to map stimuli in terms of attention value, and, more importantly, in terms of student cognitive structure (which in turn controls attention).

Group Registration of Response

The Finn, Carl Hagfors (1970), has conducted a number of studies in which the electrodermal response was recorded simultaneously

from a large group of subjects. In the composite record those responses which occurred largely at the same time throughout the group were summed in a large and prominent discursion of the recorder pen. When some few subjects were experiencing activated attention while others were experiencing inhibition, the response of the two groups tended to be cancelled in the recording. This will be clearer from Figure One. Those stimuli containing elements which aroused widely shared patterns of attention tended to produce identifiable patterns in the composite record for which Hagfors has provided a classification system (pp. 98-100). He found that his measurements were highly correlated with box office statistics for the Finnish feature films he used as stimuli (multiple correlation of +.92).

Relevance to Mass Instruction

Hagfor's group registration method has significant application to the development of mass instructional tapes and films. If composite responses from test audiences indicate low attention values for parts of the test film or tape, revisions would be indicated. Thus, it may be possible to engineer stimulus control of mass attention, or in other words, to optimize the teaching qualities of educational materials.

With the addition of analog computer circuitry a real time analyzer for group attention might be possible. A light on a display panel would represent each student in a class, all of whom would be connected to a physiological recorder. The computer circuitry would compute the class mean response then blink the display light of any student whose response pattern was more distant from the mean than two

standard deviations (or some other criterion). The instructor could then focus his own attention on these students, adapting his instruction to capture their attentional processes. In other words, his feedback to the instructor could be reinforced by physiological means to increase person-to-person interaction between faculty and student in the mass lecture environment.

Summary

Physiological indices are providing new ways of studying the learning process and promise to provide realistic audience tests of attention value for instructional films and videotapes. At the same time, an improved understanding of the "attentional potential" of our instruction may improve the richness and meaning of the campus environment.

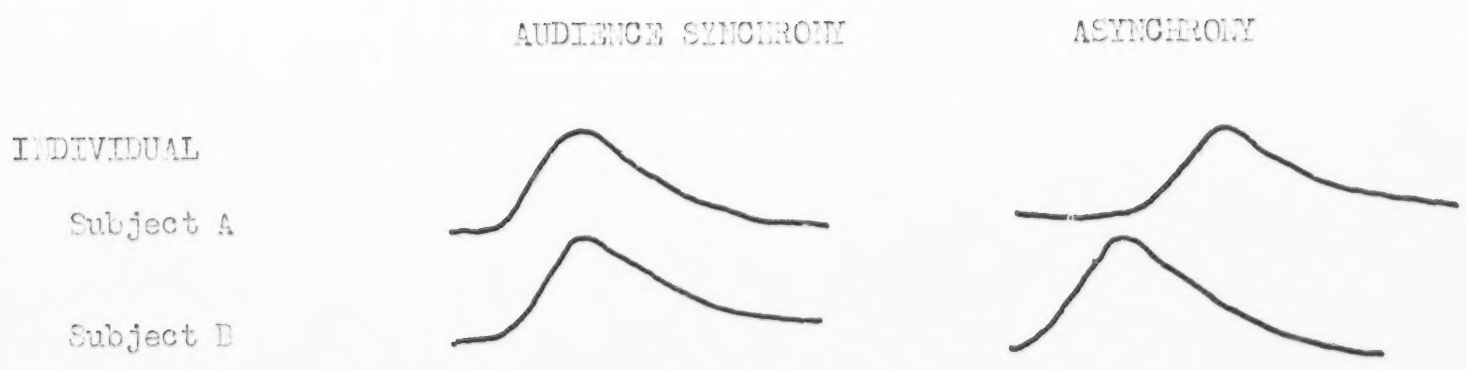

Figure One. Individual and Composite Electrodermal (Skin Conductance) Responses.

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